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Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

jc840 U.S. PTO  
09/610749  
07/06/00

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Mark Cheng, Zhi-Chun Honkasalo

WARNING: Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR 1.41(a) and 1.53(b).

For (title): DYNAMIC CONFIGURATION OF RADIO LINK PROTOCOL  
IN A TELECOMMUNICATIONS SYSTEM

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date, July 6, 2000, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL517006624US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Glenda Kastler  
(type or print name of person mailing paper)

*Glenda Kastler*  
Signature of person mailing paper

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.10(b).

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

## 1. Type of Application

This new application is for a(n)

(check one applicable item below)

☐ Original (nonprovisional)

☐ Design

☐ Plant

**WARNING:** Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

**WARNING:** Do not use this transmittal for the filing of a provisional application.

**NOTE:** If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional.

☒ Continuation.

☐ Continuation-in-part (C-I-P).

## 2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

**NOTE:** If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). [35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).] For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

**WARNING:** When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

☒ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

## 3. Papers Enclosed That Are Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

17 Pages of specification

3 Pages of claims

1 Page of Abstract

6 Sheets of drawing

☒ formal

☐ informal

**WARNING:** *DO NOT* submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

**NOTE** "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

**4. Additional papers enclosed**

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. 1.98)
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☒ Other Return Postcard

**5. Declaration or oath**

- ☒ Enclosed

Executed by

(check all applicable boxes)

- ☒ inventor(s) filed in connection with Patent Application No. 08/851,010 filed 05/05/97, of which present application is a continuation.
- ☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

- ☐ Not Enclosed.

**WARNING:** Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of **all** the above named inventor(s).

[The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently.]

**NOTE:** It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

- ☐ Showing that the filing is authorized.  
[not required unless called in question. 37 CFR 1.41(d)]

## 6. Inventorship Statement

**WARNING:** If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

- ☒ The same.

or

- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,  
☐ is submitted.  
☐ will be submitted.

## 7. Language

**NOTE:** An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

**NOTE:** A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

- ☒ English  
☐ Non-English  
☐ The attached translation is a verified translation. 37 CFR 1.52(d).

## 8. Assignment

- ☒ Copy of assignment of the invention to Nokia Mobile Phones Limited filed in connection with Patent Application No. 08/851,010 of which this application is a continuation.  
☒ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.  
☐ will follow.

**NOTE:** "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

**WARNING:** A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

## 9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. no.	Filed
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Country	Appln. no.	Filed
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Country	Appln. no.	Filed
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from which priority is claimed

☐ is (are) attached.

☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

## 10. Fee Calculation (37 C.F.R. 1.16)

A. ☒ Regular application

CLAIMS AS FILED			
Number Filed	Number Extra	Rate	Basic Fee
			37 C.F.R. 1.16(a)
			\$690.00
Total Claims			
[37 CFR 1.16(c)] 8-20 = 0	0	x \$18.00	0.00
Independent Claims [37 CFR 1.16(b)]			
3-3 = 0	0	x \$78.00	0.00
Multiple dependent claim(s), if any			
[37 CFR 1.16(d)]	0	+ \$260.00	0.00

☐ Amendment canceling extra claims is enclosed.

☐ Amendment deleting multiple-dependencies is enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation

690.00

- B. ☐ Design application  
[\$310.00—37 CFR 1.16(f)]

Filing Fee Calculation \$

- C. ☐ Plant application  
[\$480.00—37 CFR 1.16(g)]

Filing Fee Calculation \$

**11. Small Entity Statement(s)**

- ☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

**WARNING:** \*Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired." 37 C.F.R. § 1.28(a).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application.  
\_\_\_\_\_/\_\_\_\_\_, was filed on \_\_\_\_\_, from which  
benefit is being claimed for this application under:  
35 U.S.C. ☐ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),  
and which status as a small entity is still proper and desired.

- ☐ A copy of the verified statement in the prior application is included.  
Filing Fee Calculation (50% of A, B or C above)  
\$ \_\_\_\_\_

**NOTE:** Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendible under § 1.136, 37 CFR 1.28(a).

**12. Request for International-Type Search [37 C.F.R. 1.104(d)]**

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

### 13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.  
(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently).

☒ Enclosed

☒ Filing fee 690.00

☐ Recording assignment  
[\$40.00; 37 C.F.R. 1.21(h)]  
(See attached "COVER SHEET FOR ASSIGNMENT  
ACCOMPANYING NEW APPLICATION").

☐ Petition fee for filing by other than all the inventors or  
person on behalf of the inventor where inventor refused  
to sign or cannot be reached  
[\$130.00; 37 C.F.R. 1.47 and 1.17(h)]

☐ For processing an application with a specification  
in a non-English language  
[\$130.00; 37 C.F.R. 1.52(d) and 1.17(k)]

☐ Processing and retention fee  
[\$130.00; 37 C.F.R. 1.53(d) and 1.21(l)]

☐ Fee for international-type search report  
[\$40.00; 37 C.F.R. 1.21(e)]

**NOTE:** 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicates that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(d).

Total fees enclosed 690.00

### 14. Method of Payment of Fees

☐ Check in the amount of \$ \_\_\_\_\_

☒ Charge Account No. 50-0270 in the amount of 690.00

A duplicate of this transmittal is attached.

**NOTE:** Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

## 15. Authorization to Charge Additional Fees

**WARNING:** If no fees are to be paid on filing, the following items should not be completed.

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 50-0270.

☒ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fee for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency [37 CFR 1.16(d)], it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. 1.17 (application processing fees)

**WARNING:** While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).

☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

**NOTE:** 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application...prior to paying, or at the time of paying,...issue fee." From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

## 16. Instructions as to Overpayment

☒ Credit Account No. 50-0270.

☐ Refund

Reg. No. 41,270

Tel. No. (972) 894-4959



Signature of Attorney

Brian T. Rivers

(type or print name of attorney)

Nokia Inc.

6000 Connection Drive

(P.O. Address)

Irving, TX 75039



☐ **Incorporation by reference of added pages**

[check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an International Application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.]

- ☒ **Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed**

Number of pages added 1

- ☐ **Plus Added Pages for Paper Referred to in Item 4 Above**

Number of pages added \_\_\_\_\_

- ☐ **Plus "Assignment Cover Letter Accompanying New Application"**

Number of pages added \_\_\_\_\_

☐ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this transmittal with this page and check the following item)

- ☐ **This transmittal ends with this page.**

**ADDED PAGE FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF  
PRIOR U.S. APPLICATION(S) CLAIMED**

NOTE: See 37 CFR 1.78(a).

☒ This application is a

☒ continuation

☐ continuation-in-part

☐ divisional

of co-pending application(s)

☒ Application Number 08/851,010 filed on 05/05/1997.

☐ International Application \_\_\_\_\_ filed on  
\_\_\_\_\_ and which designates the U.S.

DYNAMIC CONFIGURATION OF RADIO LINK PROTOCOL  
IN A TELECOMMUNICATIONS SYSTEM

This application is a continuation of United States Application Serial No.  
08/851,010, filed on May 5, 1997.

FIELD OF THE INVENTION:

This invention relates to telecommunications systems, and, more particularly, to a method and apparatus for dynamically configuring a radio link protocol (RLP) for a telecommunications system.

BACKGROUND OF THE INVENTION:

Major cellular system types include those operating according to the Global Services for Mobile(GSM)Standard, the TIA/EIA/IS-95 Mobile Station-Base Station compatibility Standard for Dual Mode Wide Band Spread Spectrum Cellular System, the TIA/EIA/IS-136 Mobile Station-Base Station Compatibility Standard, and the TIA/EIA 553 Analog Standard(AMPS/TACS). Other major cellular systems include those operating in the personal communications system (PCS) band according to the IS-95 based ANSI-J-STD-008 1.8 - 2.0 Ghz standard or, those operating according to the GSM based PCS1900 (1900 Mhz frequency range) standard.

Currently, each of the major cellular systems standards bodies are implementing data services into their digital cellular specifications. A packet data service specification has been finalized for GSM and, packet data service specifications compatible with the IS-95 and IS-136 standards are being prepared. Another example of a data service is the TIA/EIA IS-99 Data Services Option Standard for Wideband Spread Spectrum Digital Cellular System (IS-99). IS-99 defines a connection based packet service for IS-95-A based networks. The IS-99 system provides a standard for asynchronous data service (Service Option 4) and digital Group-3 facsimile service (Service Option 5).

In an IS-99 based system, a radio link protocol (RLP) is utilized to provide an octet stream service over IS-95-A forward and reverse traffic channels. Each octet comprises 8 bits of digital data. The octet stream service carries the variable length data packets of the point to point protocol layer. The RLP divides the point to point protocol packets into IS-95-A traffic channel frames for transmission. There is no direct relationship between point to point protocol packets and IS-95-A frames. A large packet may span several IS-95-A traffic channel frames, or a single traffic channel frame may include all or part of several point to point packets. The RLP does not take the higher level traffic channel framing into account, but operates on a featureless octet stream, delivering the octets in the order received from the point to point layer. The data may be transmitted on the traffic channel as primary traffic, or, for example, along with speech, as secondary traffic. Data may also be transmitted in a signaling subchannel. IS-95 multiplex option 1 may be used at full rate, half rate and eighth rate for primary traffic and at rate 1, rate 7/8, rate 3/4, and rate 1/2, for secondary traffic.

The RLP utilizes RLP control frames to control the transmission of data and RLP data frames for the transmission of data at the RLP level.

The format of RLP control and data frames is defined so that each RLP frame includes an 8-bit sequence number field (SEQ). Each RLP data frame SEQ field contains the sequence number of that particular data frame. The sequence numbers are used to identify each received data frame and allow determination of data frames that have not been received. The RLP control frame SEQ field is not used to indicate the sequence number of the control frame, but contains the next data frame sequence number, to allow quick detection of erased data frames.

In addition to the SEQ field, each RLP data frame includes a number of data bits, with up to a maximum number of data bits allowed for each frame. The maximum number of data bits allowed in a data frame depends upon the IS-95 multiplex subchannel used. For example, for primary traffic on the traffic

channel, using multiplex option 1 at IS-95 full rate, the maximum number of data bits allowed is 152, and, for primary traffic on the traffic channel, using multiplex option 2 at IS-95 half rate, the maximum number of data bits allowed is 64. When less than the maximum number of bits are transmitted in a frame, padding is used to fill out the data field to 152 bits. Each RLP data frame also includes a RLP frame type (CTL) field, and a data length (LEN) field. The LEN field indicates the length of the data in the frame in octets. For unsegmented data frames, the CTL frame is one bit and is set to 0. For segmented data frames, the CTL frame contains 4 bits and can be set to indicate whether the data in the frame includes the first LEN octets, the next LEN octets, or, the last LEN octets of the unsegmented data frame.

The RLP control frame may function as a negative acknowledgement (NAK) RLP control frame. A (NAK) RLP control frame includes a 4 bit frame type (CTL) field, a four bit length (LEN) field, an 8 bit FIRST field, an 8 bit LAST field, a reserved field (RSVD), a frame check sequence field (FCS) and padding. An RLP control frame having the frame type field set to indicate negative acknowledgement (NAK) may then be used to request retransmission of a particular data frame, or, a particular sequence of data frames. For example, a mobile station expecting a data frame having a particular sequence number, would transmit a NAK control frame to the base station if the mobile determined that the data frame was missed. The FIRST and LAST fields of the RLP NAK control frame are used to indicate the particular data frame, or, sequence (indicated as a range beginning at the sequence number indicated by the FIRST field and ending at the sequence number indicated by the LAST field) of data frames that are requested to be retransmitted. In IS-99, the number of requests for retransmission of a data frame is a set number and the initiation of the requests for retransmission is controlled by a NAK retransmission timer. When RLP frames are carried as primary or secondary traffic, the retransmission timer is implemented as a frame counter. When RLP frames are carried in the signaling subchannel, the retransmission timer is implemented as a timer having a duration equal to a predetermined value,

T1m, that is defined in Appendix D of IS-95-A. The NAK retransmission counter for a data frame is started upon the first transmission of a NAK RLP control frame requesting retransmission of that data frame.

If the data frame has not arrived at the receiver when its NAK retransmission timer expires, the receiver sends a second NAK control frame requesting retransmission of that data frame. This NAK control frame is transmitted twice. The NAK retransmission timer for this data frame is then restarted. If the data frame has not arrived at the receiver when its NAK retransmission timer has expired twice, the receiver sends a third NAK control frame requesting retransmission of that data frame. Each NAK control frame transmitted as the result of a retransmission timer expiring a second time is transmitted three times.

A NAK abort timer is then started in the receiver upon transmission of the third NAK control frame. The NAK abort timer is implemented, and expires, identically to the NAK retransmission timer. If the data frame has not arrived at the receiver when its NAK abort timer has expired, the NAK is aborted and no further NAK control frames are transmitted for that data frame.

The IS-99 NAK scheme results in a maximum number of three retransmission requests, that include a maximum number of six NAK RLP control frames, being transmitted for a particular unreceived data frame.

As cellular telecommunications systems evolve, various high speed data (HSD) service options will be implemented into the different cellular system standards. For example, several HSD options are being considered for implementation into the IS-95-A standard. These HSD options may include IS-95-A based systems having the capability to transmit data at rates of up to 78.8 kbps. Use of any of these options in IS-95-A will increase the range of services and applications that can be supported. For an IS-99 based system, an increase in the number of services and applications that the system may support will require that the system support data services having different bandwidth, delay sensitivity and quality of service requirements (QoS).

Different bandwidth, delay sensitivity and quality of service requirements may require different bit error rate (BER), and, delay requirements. A fixed frame header and fixed NAK retransmission procedure such as that of IS-99 may not be optimally configured for certain data services that must be supported. For example, it may be that a service with low QoS requirements (high BER allowed) may experience large delays from a NAK retransmission procedure in a system having a predetermined number of retransmissions, when it is not really necessary to retransmit missing data frames the predetermined number of times in order to provide acceptable service. Another example of non-optimization in a data packet service using a fixed frame header, such as that of IS-99, could occur if a service required high bandwidth and included large numbers of sequenced data frames to be transmitted as high speed data. This service may use long data sequences having a number of data frames greater than X, which is the maximum number indicated by the full SEQ field of the fixed frame header. In this case, the count in the SEQ field would have to be restarted before a long data sequence was finished. Restarting the count in the sequence field may require more complicated processing of the transmitted and received data than having each frame in the data sequence numbered sequentially. Additionally, if a data service uses a shorter data sequence having a number of data frames less than the maximum number indicated by the SEQ field, this may be nonoptimal because bits reserved for the SEQ field go unused in each data frame, when these bits could be used to carry data.

#### OBJECTS OF THE INVENTION:

It is a first object of this invention to provide an efficient method and apparatus for transmitting data in a telecommunications network that overcomes the foregoing and other problems.

Another object of this invention is to provide a method and apparatus for dynamically configuring a radio link protocol for a particular type of data service in which the radio link protocol is to be used.

Another object of this invention is to provide a method and apparatus for dynamically configuring the number of bits to be included in a sequence numbering field of a radio link protocol frame.

A further object of this invention is to provide a method and apparatus for dynamically configuring the value of a retransmission count used to control the number of negative acknowledgements to be sent from an intended receiver, when a expected radio link protocol frame is not received at the intended receiver.

### SUMMARY OF THE INVENTION

The foregoing and other problems are overcome and the objects of the invention are realized by methods and apparatus in accordance with embodiments of this invention.

The present invention provides a method and apparatus for dynamically configuring parameters of the radio link protocol layer in a telecommunications system. The method and apparatus allows dynamic configuration of the radio link protocol layer in order to optimize parameters for use with a particular data service. The radio link protocol parameters may include parameters specifying the configuration of radio link protocol frames and/or other parameters controlling radio link protocol transmissions. The method and apparatus utilizes a configuration procedure that is performed prior to initiation of the data service between two communicating transceiving devices. The configuration may also be performed to reset parameters of the radio link protocol layer during ongoing data service.

During the configuration procedure, parameters may be agreed upon for the radio link protocol to be used in each direction on the radio link between the transceiving devices. The invention provides an advantage over telecommunications systems that use fixed frame headers, and that consequently may require larger amounts of processing when undersized fields have to be reused in the transmission, or that waste potential available



bandwidth by under-utilizing the bits of oversized fields. The invention also prevents delays or quality of service degradations that are caused by the retransmission of unreceived data frames a number of times that is either greater or less than is required by a particular data service.

In an embodiment of the invention, a radio link protocol control frame used for configuring a link setup in a data service between two communicating transceiving devices includes a sequence size field that indicates a bit length required for a frame sequence number (SEQ) field to be used in subsequent radio link protocol data frames and radio link protocol control frames. The radio link protocol control frame used for link setup may also include a retransmission field indicating the number of retransmission requests allowed for particular data frames in the data service that have been transmitted but not received. The radio link control frame is used during the initialization or the reset of the links to be used. Radio link control frames may be exchanged between the transceiving devices in order to configure radio link protocol parameters such as the size of the sequence number field and the retransmission request count for each direction on the link.

In order to configure radio link protocol parameters during initialization or to reset the radio link protocol parameters during an ongoing data service, a first transceiving device of the two communicating transceiving devices transmits a first RLP control frame to the second transceiving device. The first RLP control frame includes a sequence size field, a retransmission request field, and a field indicating that the frame includes the sequence size field and retransmission field. The first RLP control frame indicates to the second transceiving device that it is going to transmit frames to the second transceiving device that includes a (SEQ) field containing the number of bits that is indicated in the sequence size field of the first RLP control frame. The first RLP control frame also indicates to the second transceiving device in the retransmission request field the maximum number of retransmission requests allowed from the second transceiving device, for unreceived data frames transmitted on the link from the first transceiving device to the second transceiving device. The

second transceiving device receives the first RLP control frame and configures itself to receive data on the link from the first transceiving device to the second transceiving device and transmits retransmission requests for data frames unreceived on that link according to the information received in the first RLP control frame.

The second transceiving device then transmits a second RLP control frame to the first transceiving device. The second RLP control frame also includes a sequence size field, a retransmission field, and a field indicating that the frame includes the sequence size field and retransmission field. The second RLP control frame also includes an indication that the second frame is transmitted in response to receiving the first RLP control frame. The second RLP control frame indicates to the first transceiving device that the second transceiving device is to transmit frames having a sequence number (SEQ) field containing the number of bits that is indicated in the sequence size field. The second RLP control frame also indicates to the first transceiving device, in the retransmission field, a maximum number of retransmission requests allowed from the first transceiving device for unreceived data frames transmitted on the link from the second transceiving device to the first transceiving device. After receiving the second RLP control frame, the first transceiving device configures itself to receive data on the link from the second transceiving device to the first transceiving device and transmit retransmission requests for data frames unreceived on that link according to the information in the second RLP control frame. The first transceiving device then sends a control frame to the second transceiving device in acknowledgement. The first and second transceiving devices then transmit and receive data and control frames accordingly.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached Drawings, wherein:

Fig. 1 is a block diagram of a cellular terminal that is suitable for

practicing this invention;

Fig. 2 depicts the terminal of Fig. 1 in communication with a CDMA cellular network;

Figs. 3A, 3B and 3C are a pictorial representation of a radio link protocol (RLP) control frame structure employed, in accordance with the invention, by a mobile station and base station to configure the RLP for a communications link between the mobile station and base station;

Fig. 4 is a flow diagram illustrating the radio link protocol (RLP) configuration procedure according to the invention, the flow diagram being presented as Figs. 4A, 4B, and 4C.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGs. 1 and 2, therein are illustrated a wireless user terminal or mobile station (MS) 10 and cellular network 32, that is suitable for practicing this invention. The mobile station 10 includes an antenna 12 for transmitting signals to and, for receiving signals from a base site or base station (BS) 30. The (BS) 30 is a part of cellular network 32 that includes a mobile switching center (MSC) 34. The MSC 34 provides a connection to landline trunks when the MS 10 is involved in a call.

The MS 10 includes a modulator (MOD) 14A, a transmitter 14, a receiver 16, a demodulator (DEMOD) 16A, and a controller 18 that provides signals to and receives signals from modulator 14A and demodulator 16A, respectively. These signals may include signaling information, and also speech, data and/or packet data transmitted between MS 10 and BS 30 in accordance with the air interface standard of the applicable cellular system.

Controller 18 may be comprised of a digital signal processor device, a microprocessor device, and various analog to digital converters, digital to analog converters, and other support circuits. The control and signal processing functions of the mobile station are allocated between these devices according to their respective capabilities. MS 10 also includes a user interface

comprised of a conventional earphone or speaker 17, a conventional microphone 19, a display 20, and a user input device, typically a keypad 22, all of which are coupled to the controller 18. The keypad 22 includes the conventional numeric (0-9) and related keys (#,\*) 22a, and other keys 22b used for operating the mobile station 10. These other keys 22b may include, by example, a SEND key, various menu scrolling and soft keys, and a PWR key. The mobile station 10 may also include a battery 26 for powering the various circuits that are required to operate the mobile station.

The mobile station 10 also includes various memories, shown collectively as the memory 24, wherein are stored a plurality of constants and variables that are used by the controller 18 during the operation of the mobile station. For example, the memory 24 may store the values of various cellular system parameters and the number assignment module (NAM). An operating program for controlling the operation of controller 18 is also stored in the memory 24 (typically in a ROM device). The memory 24 may also store data prior to transmission or after reception. The memory 24 also includes routines for implementing the method of radio link protocol configuration according to the described embodiment of the invention.

Mobile station 10 may also function as a data terminal for transmitting or receiving data. As such, in this case MS 10 may be connected to a portable computer or a fax machine through a suitable data port (DP) 28.

BS 30 also includes the necessary transmitters and receivers to allow signal exchange with MS 10. Controllers, processors and associated memories that may be located in BS 30 or MSC 34 provide control of the BS 30 and MSC 34, and implement routines for the method and apparatus of radio link protocol configuration according to the described embodiment of the invention.

In the embodiment of this invention the MS 10 and the network 32 operate using a direct sequence, code division multiple access (DS-CDMA) system that is based on the IS-95A system standard. The network may operate in the 800 Mhz frequency range according to IS-95A standard, or, in

the 1.8 - 2.0 Ghz range according to the IS-95 based ANSI-J-STD-008 standard. The network may provide a service option feature based on the IS-99 standard and, may also use high speed data techniques that have been proposed for CDMA based systems to provide higher speed data transmission than is presently provided by the present IS-95A and IS-99 standards.

For example, more than one Walsh channel may be used on the forward link to provide high speed data, by simultaneously carrying separate data that belongs to the same user transmission. On the reverse link, multiplexed channels may be used to increase the data rate. In this method serial data is input to a transmitter/modulator at an input data rate which is higher than the base data transmission rate. The serial data is received over a time period having a duration equal to the duration of the 20 millisecond IS-95 transmission frame and demultiplexed into a plurality of sets of input data. Each of the plurality of sets of input data is then processed in one of a plurality of subchannels using a system channel encoding and interleaving scheme to generate a plurality of sets of processed data. An output serial data stream is then generated by multiplexing the plurality of sets of processed data from the subchannels together. The serial output stream is generated so that the originally received serial data included in the serial output data stream, is generated at the input data rate. The serial output data stream is then spread to generate at least one spread data stream and transmitted on the channel during a second time period having a duration equal to the duration of the IS-95 transmission frame, so that the serial data included in the at least one spread data stream is transmitted at the input data rate.

In accordance with the invention, the IS-99 RLP data and control frames are modified, so that the frames may be used in a RLP configuration process that is performed upon initiation or reset of a data service. Referring now to FIGs. 3A, 3B and 3C, therein are illustrated structures for a RLP control frame 300, an unsegmented RLP data frame 320, and a segmented RLP data frame 340, respectively, that are employed by a mobile station and base station to implement a dynamic RLP protocol in accordance with the invention. RLP

control frame 300 includes RLP frame type (CTL) field 302, sequence number (SEQ) field 304, reserved octet length (LEN) field 306, sequence size/first sequence number (SES/FIRST) field 308, retransmission number/last sequence number (RETN/LAST) field 310, reserved (RSVD) field 312, frame check sequence (FCS) field 314, and padding 316. Unsegmented RLP data frame 320 includes CTL field 322, SEQ field 324, LEN field 326, RSVD field 328, DATA field 330 and padding 332. Segmented RLP data frame 340 includes CTL field 342, SEQ field 344, LEN field 346, RSVD field 348, DATA field 350 and padding 352.

In order to implement the embodiment of the invention, the RLP control and data frame structure is modified from the IS-99 structure, so that the positions of the CTL and SEQ fields in the RLP control and data frames have been exchanged as compared to IS-99, and, so that the RLP data frame SEQ fields 324 and 344 are modified to be variable in length. In the RLP control frames, the FIRST and LAST fields have been modified to provide the SES and RETN functions, respectively. In the unsegmented and segmented RLP data frames 320 and 340, the RSVD fields 328 and 348, respectively, have been added to account for the variable length of the SEQ field.

The CTL field 302 indicates the RLP control frame type. CTL field 302 indicates whether the RLP control frame is a negative acknowledgement (NAK) control frame, SYNC control frame, an acknowledgement (ACK) control frame, or a synchronization/acknowledgement (SYNC/ACK) control frame. LEN field 306 indicates the length of RSVD field in octets and FCS field 314 provides a frame check sequence that provides an error check on the control frame 300. For the unsegmented data frame 320, the CTL field 322 may be one bit and may be set to 0. For the segmented data frame 340, CTL field 342 indicates whether the data frame 340 contains the first, last, or a middle segment of the segmented data. LEN fields 326 and 346 indicate the length of the DATA field 330 and 340, respectively.

The memory associated with the controller in each of the MS 10 and BS

30 includes values stored for V1(ses), V1(retn), V2(ses) and V2(retn). V1(ses) is the value, in bits for the size of the SEQ fields 304, 324 or 344, when a RLP frame is transmitted on the forward link, and V1(retn) is the maximum number of retransmission requests allowed on the reverse link for an unreceived data frame that was transmitted on the forward link. V2(ses) is the value for the size of the SEQ fields 304, 324 or 344 when an RLP frame is transmit on the reverse link and V2(retn) is the maximum number of retransmission requests allowed on the forward link for an unreceived data frame that was transmitted on the reverse link. V1(ses) and V1(retn) are determined in BS 30, and V2(ses) and V2(retn) are determined in MS 10. These values may be determined by the controllers within MS 10 and BS 30 according to information on the data service to be used, for example, based on data rate, number of frames, quality of service, etc., or, the appropriate values may be input to MS 10 and BS 30 from the termination points of the data link, for example, from a fax machine connected to MS 10. The values are then exchanged during radio link protocol configuration so that each of MS 10 and BS 30 has the protocol information for both forward and reverse links. The controllers in MS 10 and BS 30 are configured to format and transmit RLP frames, transmit retransmission requests, and receive RLP frames according to these values.

Referring now to Fig. 4, therein is a flow diagram illustrating the radio link protocol configuration procedure according to the invention. In the embodiment of the invention, the procedure of Fig. 4 may be used upon initiation of a data service between MS 10 and network 32 of Fig. 2. The procedure of Fig. 4 may also be used to reset the RLP protocol parameters for a data service after the data service has been initiated. Although described in the context of a mobile station originated synchronization procedure, it should be realized that the process is symmetrical, and that the base station 30 can originate the procedure as well.

The process begins at step 402. The configuration is implemented, preferably, so that the configuration process is embedded in the connection initialization process. The messages exchanged perform the dual function of

initializing the connection and configuring the dynamic RLP. At step 404, the RLP configuration process begins using the modified RLP control frames in accordance with this invention. A SYNC control frame (CTL=1101) is formatted within MS 10 having the SES/FIRST field 308 set to the value of X1, and the RETN/LAST field 310 set to the value of Y1. At step 406, MS 10 then transmits the SYNC control frame to BS 30. At step 408, a determination is made within BS 30 as to whether or not SES/FIRST field 308 of the SYNC control frame is set to 0, i.e., whether X1 has been assigned the value of 0. If the SES/FIRST field 308 is set to 0, the process moves to step 412. At step 412, V<sub>1</sub>(ses) is set to the default value for the sequence size in bits of the SEQ field 322/344 to be used on the reverse link for RLP data frames. In the embodiment of the invention, the default value may be set to 8. The process next moves to step 416.

If, however, at step 408, it is determined that SES/FIRST field 308 is not set to 0, the process moves to step 410. At step 410, a determination is made within BS 30 as to whether or not the value of X1 in the SES/FIRST field 308 is a valid value. To be considered a valid value, the value of SES/FIRST field 308 must be a value within the predetermined range of from 8 to 12. If the value of SES/FIRST field 308 is not valid, the process moves to the block labeled as "A". In this case the entity detecting the invalid condition restarts the initialization procedure. That is, and by example, if the base station 30 detects an invalid parameter at Block 410, the base station 30 sends a SYNC frame to the mobile station 10. Since the mobile station 10 is expecting a SYNC/ACK frame, the receipt of the SYNC frame indicates to the mobile station 10 that the base station 30 found one or more parameters objectionable, and was replying with base station preferred parameters.

If however, the value of SES/FIRST field 308 is valid, the process moves to step 414. At step 414, V<sub>1</sub>(ses) is set to X1 within BS 30. BS 30 is now configured to use X1 for the sequence size in bits of the SEQ field 322/344 for RLP data frames 320/340 received on the reverse link from MS 10.



Next, at step 416, a determination is made within BS 30 as to whether the RETN/LAST field 310 of RLP control frame 300 is set to 0, i.e., whether Y1 has been assigned the value of 0. If RETN/LAST field 310 is set to 0, the process moves to step 420. At step 420,  $V_1(\text{retn})$  is set to the default value for the maximum number of retransmission requests from BS 30 for unreceived RLP data frames transmit from the MS 10 on the reverse link. In the embodiment of the invention, the default value may be set to 0. The process next moves to step 424.

If however, at step 416, it is determined that RETN/LAST field 310 is not set to 0, the process moves to step 418. At step 418 a determination is made within BS 30 as to whether or not the value of Y1 in the RETN/LAST field 310 is a valid value. To be considered a valid value, the value of RETN/LAST field 310 should be a value within a predetermined range. In the embodiment of the invention the predetermined range may be from 0 to 3. If the value of RETN/LAST field 310 is not valid, the process moves to Block A, as described above, and the synchronization procedure begins again. If, however, the value of RETN/LAST field 310 is valid, the process moves to step 422. At step 422,  $V_1(\text{retn})$  is set to Y1 within BS 30. BS 30 is now configured to use Y1 for the maximum number of retransmission requests to be allowed from BS 30 for unreceived RLP data frames transmitted from MS 10 on the reverse link.

Next, at base station executed step 424, a SYNC/ACK control frame (CTL=1111) is formatted with SES/FIRST field 308 set to the value of X2 and, the RETN/LAST field 310 set to the value of Y2. At step 426, the BS 30 transmits the SYNC/ACK control frame to the MS 10. Next, at step 428, a determination is made within MS 10 as to whether or not the SES/FIRST field 308 of SYNC/ACK control frame is set to 0, i.e., whether X2 has been assigned the value of 0. If the SES/FIRST field 308 is set to 0, the process moves to step 432. At step 432,  $V_2(\text{ses})$  is set to the default value for the sequence size in bits of the SEQ field 322/344 to be used on the forward link for RLP data frames. In the embodiment of the invention, the default value may be set to 8. The process next moves to step 436.

If however, at step 428, it is determined that SES/FIRST field 308 is not set to 0, the process moves to step 430. At step 430, a determination is made within MS 10 as to whether or not the value of X2 in the SES/FIRST field 308 is a valid value. To be considered a valid value, the value of SES/FIRST field 308 must be a value within the predetermined range. In the embodiment of the invention, as for V1(ses), the predetermined range may be from 8 to 12. If the value of SES/FIRST field 308 is not valid, the process moves to Block B (in this case equivalent to step 402) where the MS 10 sends a SYNC frame to the BS 30, thereby restarting the synchronization process. If however, the value of SES/FIRST field 308 is valid, the process moves to step 434. At step 434, V2(ses) is set to X2 within MS 10. MS 30 is now configured to use X2 for the sequence size in bits of the SEQ field 322/344 for RLP data frames 320/340 received on the forward link from BS 30.

Next, at step 436, a determination is made within MS 10 as to whether the RETN/LAST field 310 of the SYNC/AK control frame is set to 0, i.e., whether Y2 has been assigned the value of 0. If the RETN/LAST field 310 is set to 0, the process moves to step 440. At step 440, V2(retn)) is set to the default value for the maximum number of retransmission requests allowed from MS 10 for unreceived RLP data frames transmitted from BS 30 on the forward link. In the embodiment of the invention, the default value may be set to 0. The process next moves to step 444.

If however, at step 436, it is determined that RETN/LAST field 310 is not set to 0, the process moves to step 438. At step 438, a determination is made within MS 10 as to whether or not the value of Y2 in the RETN/LAST field 310 is a valid value. To be considered a valid value, the value of RETN/LAST field 310 must be a value within a predetermined range. In the embodiment of the invention, as for V2(retn), the predetermined range may be from 0 to 3. If the value of RETN/LAST field 310 is not valid, the process moves to Block B, as described above. If however, the value of RETN/LAST field 310 is valid, the process moves to step 442. At step 442, V2(retn) is set to Y2 within MS 10. MS 10 is now configured to use Y2 for the maximum number of retransmission

requests to be allowed from MS 10 for unreceived RLP data frames transmitted from BS 30 on the forward link.

Next, at step 444, an ACK control frame (CTL=1101) is formatted with SES/FIRST field 308 set to the value of X1 and the RETN/LAST field 310 set to the value of Y1. At step 446, the MS 10 then transmits the ACK control frame to BS 30. The ACK control frame serves as confirmation from MS 10 to BS 30 that the control frames required for configuring the RLP have been exchanged. At step 448, a determination is made within BS 30 as to whether or not the SES/FIRST field 308 of the ACK control frame 300 is set to X1 and whether or not the RETN/LAST field 310 is set to Y1. If the SES/FIRST field 308 is set to X1 and the RETN/LAST field 310 is set to Y1, the configuration is confirmed and the process moves to step 450. At step 450 the configuration process ends, and data transmission between MS 10 and BS 30 proceeds. RLP frames transmitted by MS 10 on the reverse link are received by BS 30 according to X1, and retransmission requests for those are transmitted by BS 30 according to Y1. RLP frames transmitted by BS 30 on the forward link are received by MS 10 according to X2, and retransmission requests for those frames are transmitted by MS 10 according to Y2.

Although described above with respect to certain programmable parameters (i.e., the sequence number field and number of retransmissions), it is within the scope of this invention to provide other programmable parameters. By example, the number of CRC check bits can be made programmable and can be specified using the signaling described above.

Thus, while the invention has been particularly shown and described with respect to a preferred embodiment thereof, it will be understood by those skilled in the art that changes in form and details may be made therein without departing from the scope and spirit of the invention.

CLAIMS

What is claimed is:

1           1. A method for communicating between a first device and a second  
2 device using at least one variable parameter, said method comprising the steps  
3 of:

4           transmitting a message from the first device to the second device, said  
5 message including information indicating a length of a sequence number  
6 field included in each of a plurality of transmission frames;

7           receiving said message at the second device;

8           storing, in response to receiving said message, said information in the  
9 second device;

10          transmitting said plurality of transmission frames from the first device;

11          receiving said plurality of transmission frames at the second device and  
12 processing each sequence number field of said plurality of transmission  
13 frames according to said information stored in the second device.

1           2. The method of claim 1, wherein said message, said information and  
2 said plurality of transmission frames comprise a first message, second  
3 information and, first plurality of transmission frames, respectively, and wherein  
4 said method of further comprises the steps of:

5           transmitting, in response to receiving said first message, a  
6 second message from the second device to said first device, said  
7 second message including second information indicating a length  
8 of a sequence number field included in each of a second plurality  
9 of transmission frames;

10          receiving said second message at the first transceiving device;

11 storing in response to receiving said second message, said  
12 second information in the first device;

13 transmitting said second plurality of transmission frames from the  
14 second device; and

15 receiving said second plurality transmission frames at the first  
16 transceiving device, and processing each sequence number field of said  
17 second plurality of transmission frames according to said information  
18 stored in said first device.

1 3. The method of claim 2, wherein said first and second messages  
2 comprise RLP control frames, and wherein said first and second plurality of  
3 transmission frames comprise RLP data frames.

1 4. A mobile station for operation in a telecommunications system having  
2 a base station, wherein data is transmitted from the base station in  
3 transmission frames, said mobile station comprising:

4 a receiver for receiving a message from the base station, said message  
5 including information indicating the length of a sequence number  
6 included in each of a sequence of transmission frames, said receiver  
7 further for receiving said sequence of transmission frames, subsequent  
8 to receiving said message;

9 a memory device; and

10 a controller coupled to said receiver and said memory device, said  
11 controller for receiving said information from said receiver, storing said  
12 information in said memory device, and processing each sequence  
13 number field of said sequence of transmission frames according to said  
14 information.

1 5. The mobile station of claim 4, wherein said sequence of transmission  
2 frames comprises a first sequence of transmission frames, said message  
3 comprises a first message, and, wherein data is transmitted from said mobile

4 station to said base station in a second sequence of transmission frames and  
5 wherein said mobile station further comprises a transmitter for transmitting said  
6 second sequence of transmission frames, and wherein said controller, further,  
7 generates a second message, said second message including information  
8 indicating the length of a sequence number included in each of said second  
9 sequence of transmission frames, and initiates transmission of said second  
10 message to said base station from said transmitter prior to transmitting said  
11 second sequence of transmission frames.

1 6. The mobile station of claim 5, wherein said first and second  
2 messages comprise RLP control frames and said first and second sequences  
3 of transmission frames comprise RLP data frames.

1 7. A method for transmitting data between a mobile station and a base  
2 station in a wireless communications system, comprising steps of:

3 prior to transmitting data, exchanging communications control  
4 information between the mobile station and the base station, the control  
5 information comprising a first field for specifying a length of a variable  
6 length data frame sequence;

7 storing the exchanged information in both the mobile station and the  
8 base station; and

9 subsequently transmitting frames of data in accordance with the stored  
10 information.

8. A method as in claim 7, wherein the wireless communications  
system is implemented as a DS-CDMA system.

DYNAMIC CONFIGURATION OF RADIO LINK PROTOCOL  
IN A TELECOMMUNICATIONS SYSTEM

ABSTRACT OF THE DISCLOSURE

A method and apparatus for dynamically configuring parameters of the radio link protocol layer in a telecommunications system. The method and apparatus allows dynamic configuration of the radio link protocol layer in order to optimize parameters for use with a particular data service. In an embodiment of the invention, radio link protocol control frames used for connection initialization include RLP parameter data. The RLP parameter data is exchanged between two communicating transceiving devices during connection initialization, and is used in each transceiving device to configure subsequently transmitted RLP data frames and transmit retransmission requests accordingly.

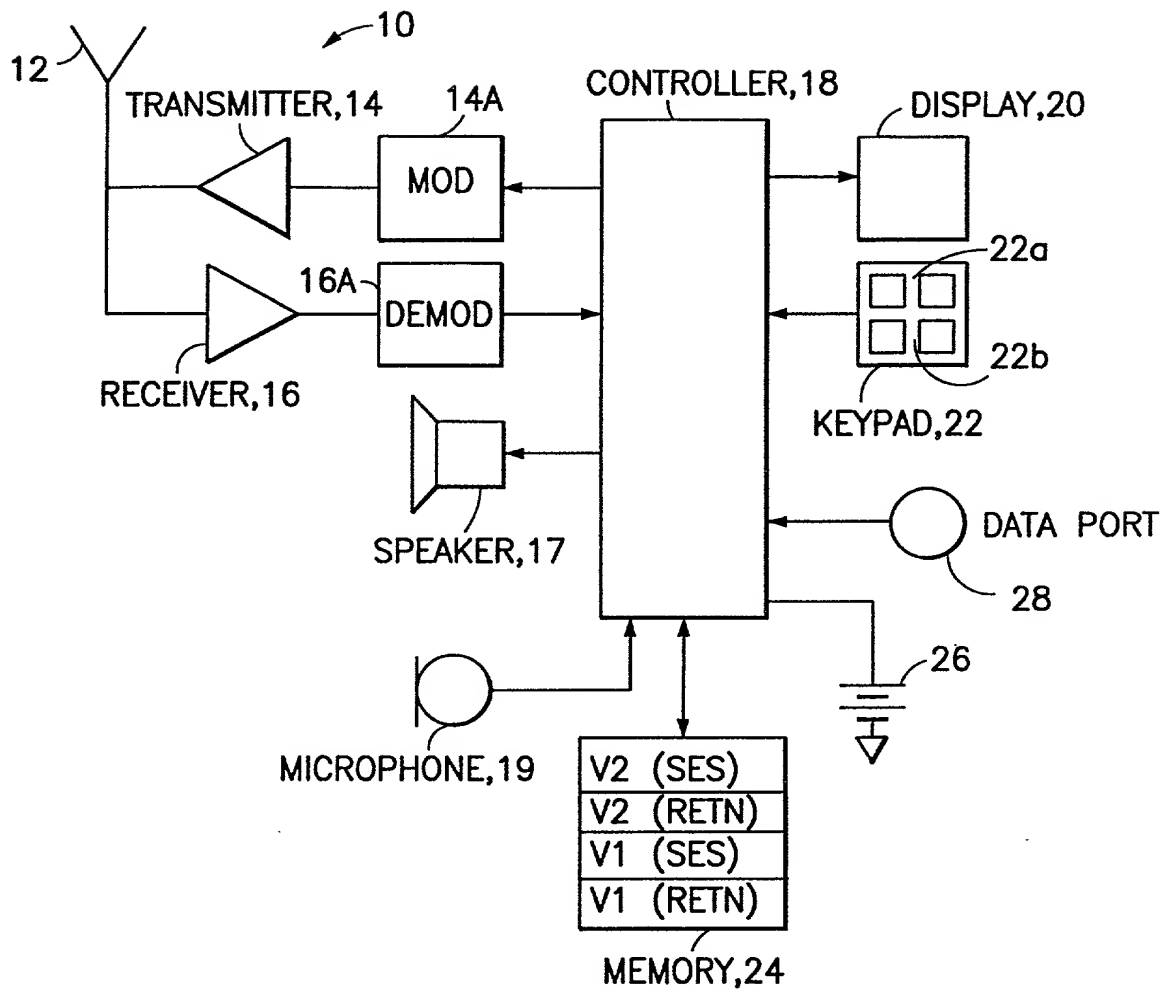


FIG. 1



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NETWORK, 32

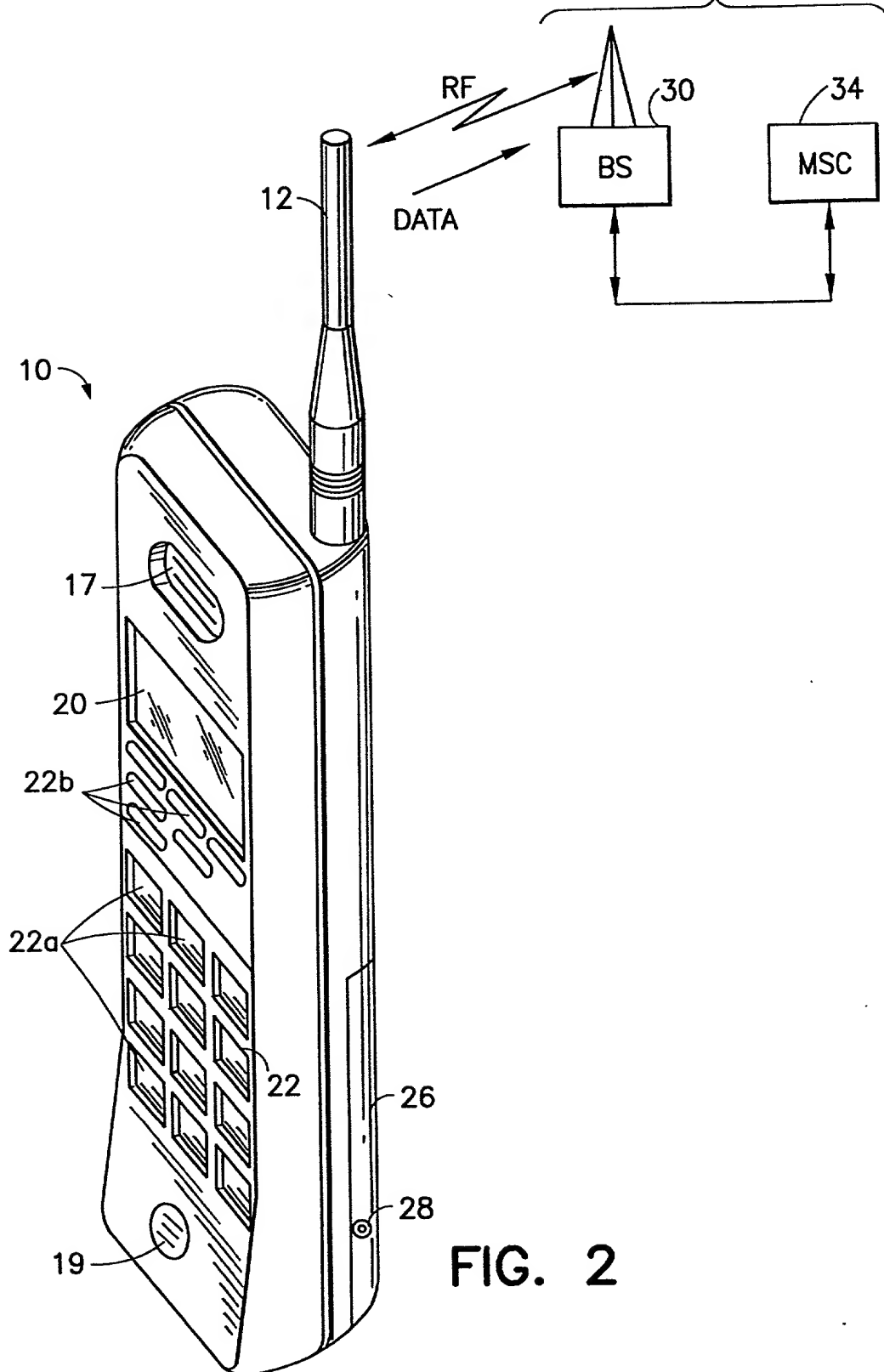


FIG. 2

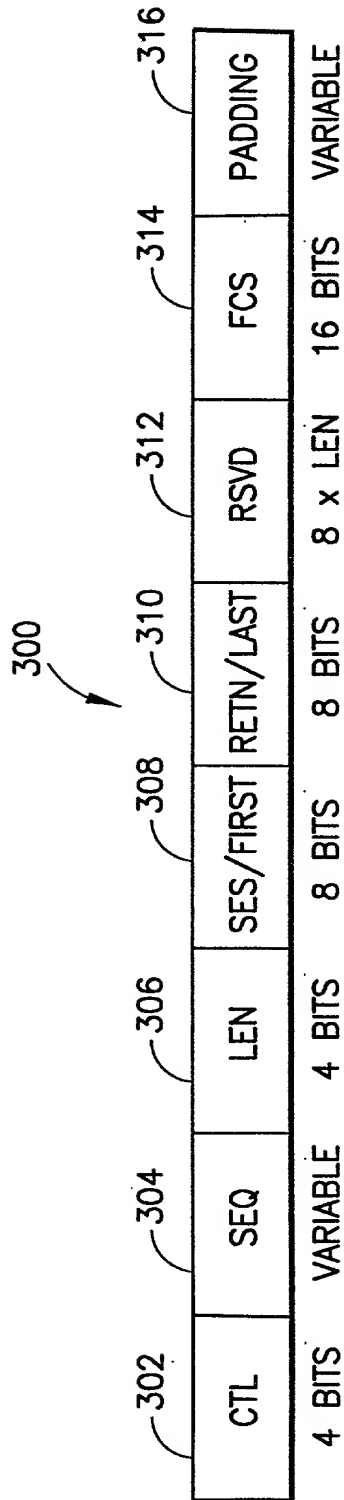


FIG. 3A

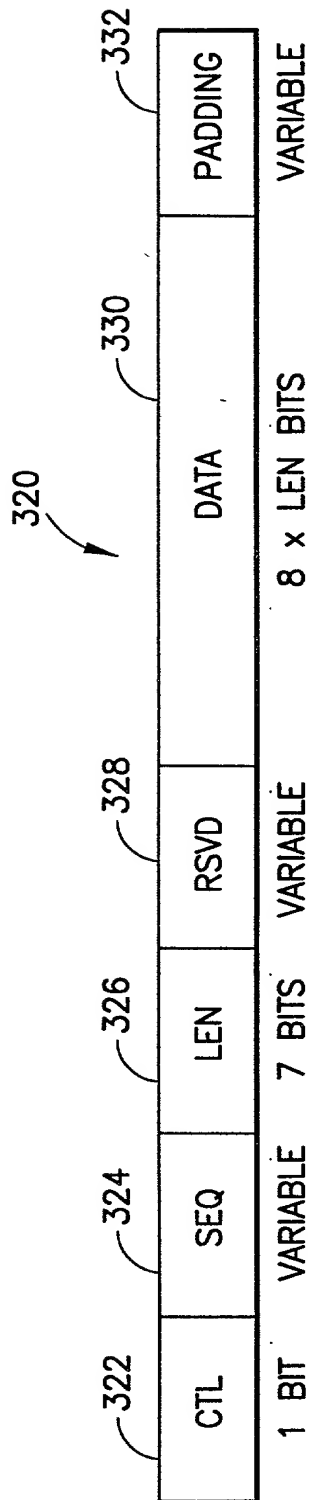


FIG. 3B

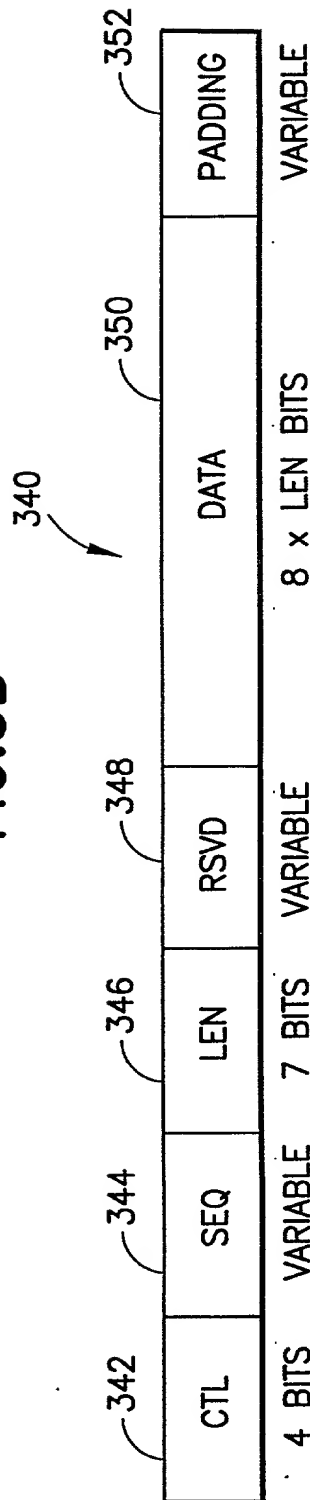


FIG. 3C

FIG.4A  
FIG.4B  
FIG.4C

FIG.4

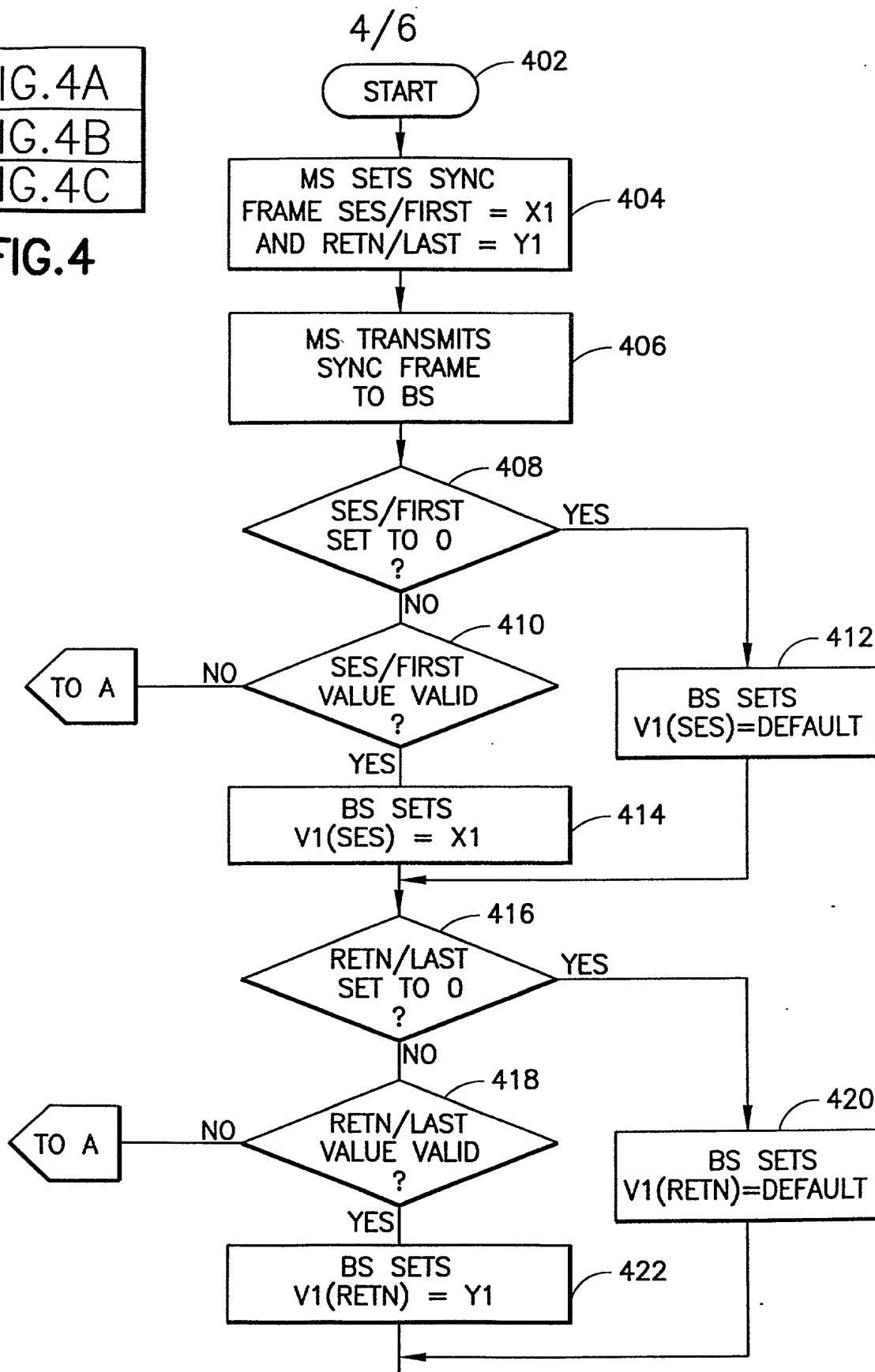


FIG.4A

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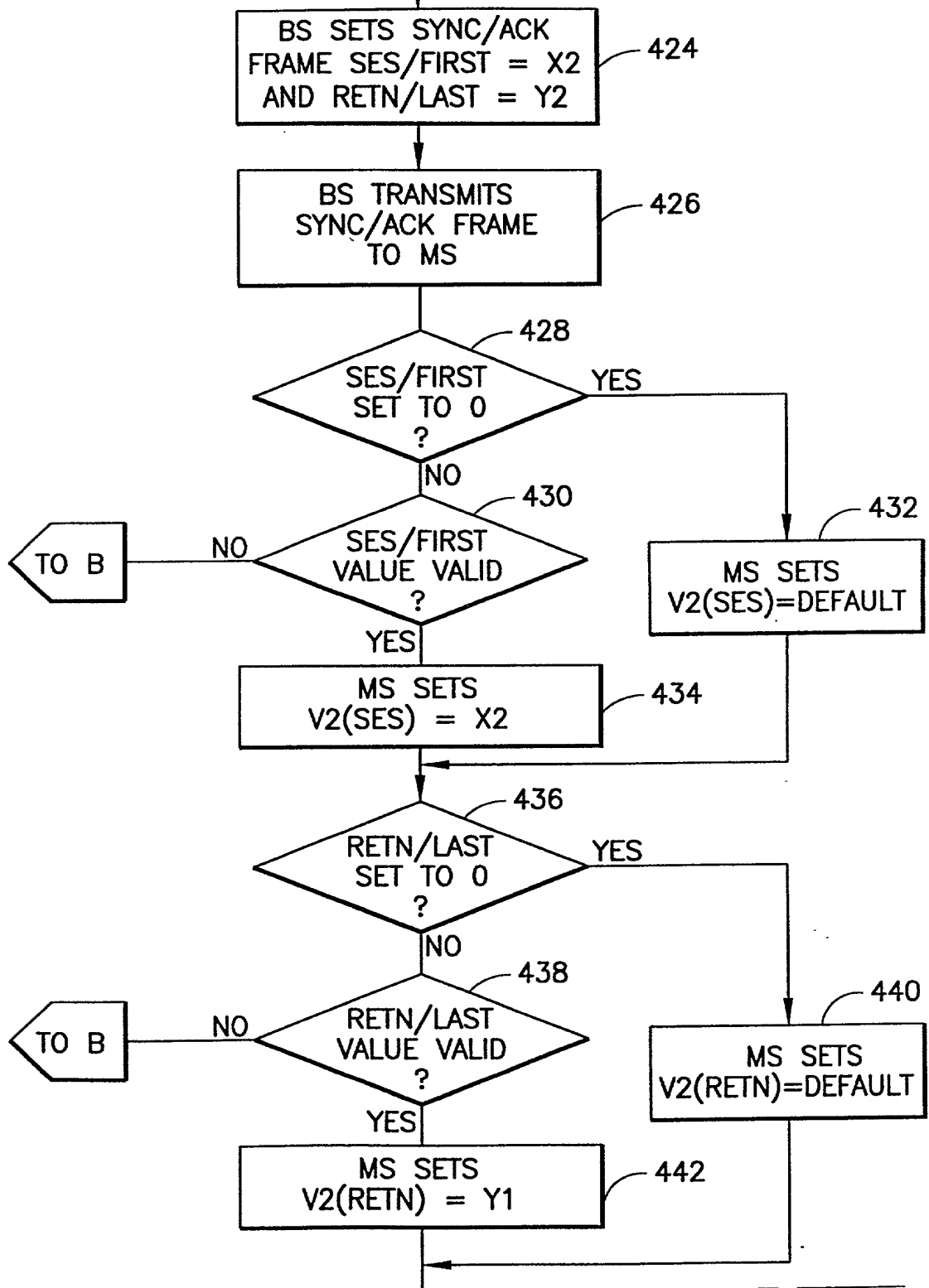


FIG. 4B

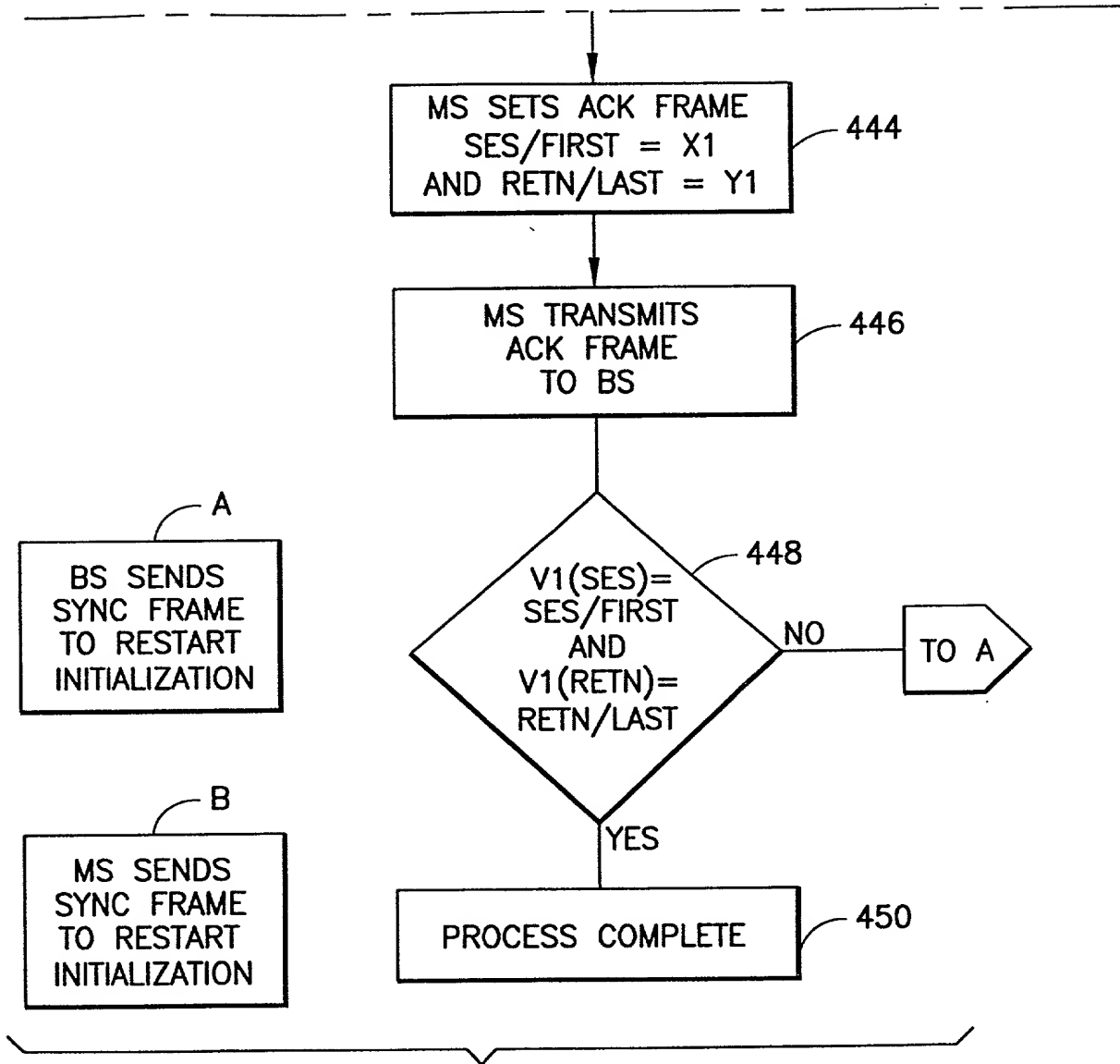


FIG. 4C

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**COMBINED DECLARATION AND POWER OF ATTORNEY**

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,  
CONTINUATION, OR C-I-P)

---

As a below named inventor, I hereby declare that:

**TYPE OF DECLARATION**

This declaration is of the following type:

(check one applicable item below)

- ☒ original.  
☐ design.  
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☐ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

NOTE: See 37 C.F.R. § 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

- ☐ divisional.  
☐ continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. § 1.53(b) (application filing requirements — nonprovisional application).

- ☐ continuation-in-part (C-I-P).

**INVENTORSHIP IDENTIFICATION**

**WARNING:** If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

**TITLE OF INVENTION**

---

Dynamic Configuration Of Radio Link Protocol In A Telecommunications System

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## SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b), or (c))

(a) ☐ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed; or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☒ was filed on 5/5/97, as ☒ Serial No. 08 / 851,010  
or ☐ \_\_\_\_\_  
and was amended on \_\_\_\_\_ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and application number (consisting of the series code and the serial number; e.g., 08/123,456);

"(2) name of inventor(s), serial number and filing date;

"(3) name of inventor(s) and attorney docket number which was on the specification as filed;

"(4) name of inventor(s), title which was on the specification as filed and filing date;

"(5) name of inventor(s), title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(6) name of inventor(s), title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number; e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

Notice of July 13, 1995 (1177 O.G. 60).

(c) ☐ was described and claimed in PCT International Application No. \_\_\_\_\_, filed on \_\_\_\_\_ and as amended under PCT Article 19 on \_\_\_\_\_ (if any).

**SUPPLEMENTAL DECLARATION (37 C.F.R. § 1.67(b))**

*(complete the following where a supplemental declaration is being submitted)*

- ☐ I hereby declare that the subject matter of the
- ☐ attached amendment
  - ☐ amendment filed on \_\_\_\_\_

was part of my/our invention and was invented before the filing date of the original application, above-identified, for such invention.

**ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR**

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

*(also check the following items, if desired)*

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

**PRIORITY CLAIM (35 U.S.C. §§ 119(a)-(d))**

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

*(complete (d) or (e))*

- (d) ☒ no such applications have been filed.
- (e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

(Declaration and Power of Attorney [1-1]—page 3 of 7)



**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION  
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			<input type="checkbox"/> YES    NO <input type="checkbox"/>
			<input type="checkbox"/> YES    NO <input type="checkbox"/>
			<input type="checkbox"/> YES    NO <input type="checkbox"/>
			<input type="checkbox"/> YES    NO <input type="checkbox"/>
			<input type="checkbox"/> YES    NO <input type="checkbox"/>

**CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)**  
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

\_\_\_\_\_/\_\_\_\_\_  
\_\_\_\_\_/\_\_\_\_\_  
\_\_\_\_\_/\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)  
UNDER 35 U.S.C. 120**

- ☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

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**NOTE:** If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete **ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION** for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

**POWER OF ATTORNEY**

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

*(list name and registration number)*

Brian T. Rivers (41,270)

Clarence A. Green (24,622)

Harry F. Smith (32,493)

Mark F. Harrington (31,686)

*(check the following item, if applicable)*

- ☐ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

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**SEND CORRESPONDENCE TO**

☒ **Address**

Harry F. Smith, Esq.  
Perman & Green, LLP  
425 Post Road  
Fairfield, CT 06430

**DIRECT TELEPHONE CALLS TO:**  
*(Name and telephone number)*

Harry F. Smith  
(203) 259-1800

☐ **Customer Number** \_\_\_\_\_

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## DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

## SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor

Mark \_\_\_\_\_ Cheng  
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)  
Inventor's signature Mark W. Cheng  
Date April 17, 1998 Country of Citizenship USA  
Residence 2508 Highland Meadows, Colleyville, TX 76034  
Post Office Address 2508 Highland Meadows, Colleyville, TX 76034

Full name of second joint inventor, if any

Zhichun \_\_\_\_\_ Honkasalo  
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)  
Inventor's signature Zhichun Honkasalo  
Date 2.4.98 Country of Citizenship British  
Residence Haravakuja 12, 01660 Vantaa, Finland  
Post Office Address Haravakuja 12, 01660 Vantaa, Finland

Full name of third joint inventor, if any

\_\_\_\_\_  
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)  
Inventor's signature \_\_\_\_\_  
Date \_\_\_\_\_ Country of Citizenship \_\_\_\_\_  
Residence \_\_\_\_\_  
Post Office Address \_\_\_\_\_

(check proper box(es) for any of the following added page(s)  
that form a part of this declaration)

☐ **Signature** for fourth and subsequent joint inventors. *Number of pages added*  
\_\_\_\_\_

\* \* \*

☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* \_\_\_\_\_

\* \* \*

☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* \_\_\_\_\_

\* \* \*

☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

\* \* \*

☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added \_\_\_\_\_

\* \* \*

☐ Authorization of practitioner(s) to accept and follow instructions from representative.

\* \* \*

(if no further pages form a part of this Declaration,  
then end this Declaration with this page and check the following item)

☒ This declaration ends with this page.